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POULTRY MANAGEMENT IN SUBTROPICAL, SEMIARID CLIMATES [1]

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AREAS HAVING A SUBTROPICAL, SEMIARID CLIMATE

In the United States a subtropical, semiarid climate is found in parts of southern Arizona, southern California, and southwestern Texas. A number of other places, for instance certain parts of India and Africa, also have such a climate. Climatic conditions like those at Phoenix, Ariz., or within the limits of the Salt River Valley of Arizona, occur near Lahore, India, and Cairo, Egypt. Florida has a subtropical climate that is not semiarid, and there are a number of areas in western and southwestern United States where the climate is semiarid but not subtropical.

The following discussion of poultry management as it applies to a subtropical, semiarid climate is based largely upon experimental studies and other observations made in the Salt River Valley of Arizona. In this section the winters are mild, the summers are hot, there is an abundance of sunshine, the relative humidity is low, and the average annual precipitation is light. These features are characteristic of a subtropical, semiarid climate, although different areas with such a climate may differ slightly in such details as average temperature and average annual precipitation. A considerable difference between day and night temperatures is also common, the range sometimes exceeding 40° F.

[1] The main object of this circular is to emphasize certain features more or less peculiar to subtropical, semiarid climates. Farmers' Bulletins that contain more information about the various phases of poultry raising may be obtained from the U. S. Department of Agriculture.

[2] In cooperation with the Animal Husbandry Division of the Bureau.

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Velocity of wind is a variable feature even among areas where the climate is otherwise similar, and may be the limiting factor in the successful use of the tent for brooding chicks or the houseless system for mature flocks as described later in this circular. The average wind velocity at Phoenix is low and the winds are not violent at their extremes.

CHOOSING A BREED

The choice of a breed is, to a large extent, the problem of the individual poultryman. In the Salt River Valley the Rhode Island Red is the most popular general-purpose chicken, largely because several good breeding flocks have existed in this part of the State for several years. There is no reason why a good laying strain of any general-purpose breed would not be equally as profitable as the Rhode Island Red.

When the eggs are the principal source of income, the Single Comb White Leghorn is the most popular chicken, although it is entirely possible that other varieties of Leghorns, or other breeds of chickens, would be equally as profitable. When the profits must come largely from the sale of poultry meat, one of the general-purpose or dual-purpose breeds, such as the Rhode Island Red or Plymouth Rock would be more suitable. Because of the combination of meat and egg-producing qualities, the dual-purpose breeds are usually found on farms where poultry keeping is a minor enterprise and the farmer wants both eggs and poultry meat for his own table.

MARKET PREFERENCES

The desires of the local market for poultry products should be considered when a breed is chosen. Eggs with white shells bring a premium on most markets, while eggs with brown shells bring the highest price on others. On some markets, such as Phoenix, Ariz., a higher price per pound is paid for "colored" meat chickens, although a premium is paid for white-shelled eggs. The poultryman should, therefore, consider his local market as Rhode Island Reds or Plymouth Rocks usually bring in greater returns than White Leghorns when sold for meat, but the eggs from such a general-purpose flock bring less than those laid by Leghorns because of shell color. Cross-breds are used to some extent for egg and meat production. One of the most popular cross-breds in the Southwest when the pullets are saved for egg production is the Austrawhite, a cross of Black Australorps and Single Comb White Leghorns. This cross makes a good market fowl.

EFFECT OF WEATHER ON DIFFERENT BREEDS

Heat prostration among laying birds is often a factor of considerable importance in regions where summer temperatures are high. The inexperienced poultryman frequently wonders whether deaths from heat are more numerous in the general-purpose breeds such as Rhode Island Reds than in the lighter breeds such as Leghorns. Apparently there is no difference, although more care may have to be used in feeding the general-purpose breeds in order that they are not overly fat during hot weather.

REPRODUCING THE FLOCK

A high rate of mortality in the flock is often a serious problem of the poultryman, and excessive mortality frequently indicates a lack of constitutional vigor. In other words, if chicks are to survive during the brooding and rearing periods and develop into healthy, mature birds, they must be healthy and vigorous when they are hatched. Thus, one of the first steps in solving the mortality problem is to start with vigorous breeders.

The vigorous fowl has bright, prominent eyes; comb and wattles of good texture and color; a rather deep, broad head; a relatively deep body; and is reasonably fleshy. The bird with low vitality has dull, sunken eyes; very fine, or coarse, comb and wattles; a small body capacity; and may be either thin or excessively fat.

SELECTING BREEDERS

It is not usually considered a good plan to use pullets for breeders, since chicks hatched from pullet's eggs are likely to be weaker than those hatched from hen's eggs. If pullets are used, it is desirable that they should have been in production for several months and then molted.

Since the chick inherits one-half of its characteristics from its sire, and one male usually has many more offspring than any one female, special care should be taken in selecting the male breeders. It is desirable that the male breeders be descended from long-lived parent stock of a good-laying strain. It is sometimes necessary to use a cockerel with old hens in order to obtain good fertility in eggs, but it is preferable to use the oldest satisfactory male available so that there are available records of his sisters, brothers, and progeny, as well as his ancestors. Some consideration should be given to the standard qualifications of the breed and variety, even though the breeders are selected primarily for egg production.

SELECTING FOR EGG PRODUCTION

Most poultrymen cannot afford to trap-nest the layers or pedigree-hatch eggs as a part of their system for improving egg production. However, good annual egg production is associated with a number of factors that may easily be observed and recorded. Early maturity, molting late in the first laying year, and lack of broodiness are associated with good egg production, and each factor may be recorded by placing celluloid leg bands on the individuals.

A celluloid band of one color may be used for pullets that lay before they are 6 months old. Those that commence laying between the ages of 6 and 7 months may be marked with leg bands of another color. Hens that become broody should be taken out of the breeding flock because broodiness is an inherited character and is not desirable in a flock of high producers. If the broody hens are not marketed at once, a leg band of different color than that used to indicate time of maturity may be used to mark them for later disposal.

Molting late in the first laying year is an indication of good egg production; poor layers molt early. Rapid molting also indicates good laying ability, provided that the molt was not caused by

environmental conditions or changes in management practices. Changing feed suddenly or moving laying fowls to a different location usually causes them to molt. Even a sudden and rapid rise in temperature (from 110° to 114° F.) has been known to cause a flock to molt.

PRODUCTION OF HATCHING EGGS

Hatching eggs should be saved only from healthy hens which have been carefully selected for egg production. The eggs should be uniform in shape and color, weigh at least $1\frac{11}{12}$ ounces each, have sound shells, and should be free from dirt. In subtropical, semiarid areas there is an abundance of sunshine, and the breeding stock ordinarily receives plenty of it. Under such conditions it is not necessary to use any special feed to supply vitamin D.

Nesting material and floor litter should be kept clean and dry to prevent the eggs from becoming dirty. Ample nesting material in the nests helps to prevent the cracking of eggs. Cracked eggs, of course, should not be incubated since they will not hatch. When cottonseed hulls are cheap, they are satisfactory for use in nests. In spite of popular belief to the contrary, the use of cottonseed hulls for nesting material does not lower the hatchability of eggs. Crushed oystershell or limestone should be kept before the birds at all times as this material is essential for the production of eggs with shells that will not crack readily.

Fresh green feed should be fed to breeding stock, at least partly because of its vitamin content. Leafy alfalfa hay may be fed from suitable racks or alfalfa-leaf meals mixed with the mash feed to take the place of fresh green feed. Biologically tested cod-liver oil also may be mixed with the mash to supply the necessary vitamin A. Milk in some form is an excellent source of vitamin G which is necessary for good hatchability. This vitamin is also found in fresh and dried greens.

While fertile eggs may be obtained sooner, it is preferable to mate breeding stock at least 10 days before the eggs are to be saved for hatching. Eggs should remain fertile for 5 or 6 days after the males are removed from the breeding pen. One male is generally used for about 15 females, but that ratio will vary somewhat according to the size of the flock and the activity of the fowls. In the case of large flocks and those of the heavier breeds a larger proportion of males is advisable.

CARE OF EGGS FOR HATCHING

Hatching eggs should be gathered frequently and kept in a well-ventilated place at a temperature of from 50° to 65° F. This is particularly important in subtropical climates where the temperature of the air during the breeding season is frequently above that required to start the chick embryo to develop.

In subtropical, semiarid climates hatching eggs should not be kept more than 10 days during the cooler months, and probably not more than 7 days during the spring and fall months. The eggs should be turned several times daily while they are being held for incubation. An easy way to turn the eggs is to place them in cases with covers and turn the cases.

INCUBATION

Natural incubation, or incubating eggs under hens, is practiced only when small numbers of chicks are to be raised. When relatively large numbers are desired or when chicks are required during the fall, winter, and early spring months, it is necessary to hatch them in an incubator or purchase chicks from a hatchery.

The production of baby chicks has become rather a specialized industry, as the purchase of adequate hatching equipment requires more capital than the average commercial poultryman has available or is disposed to invest. Instead of owning and operating his own incubator, a poultryman may have the eggs from his own breeding flock custom-hatched at a reasonable price or he may buy baby chicks direct from the hatcheryman. When chicks are purchased, it is advisable to know that the parent stock has been selected in accordance with the suggestions previously made for reproducing the flock.

THE INCUBATOR ROOM

Because of the considerable difference between day and night temperatures in regions with subtropical, semiarid climates, it is important that the incubator be placed in a room so constructed that its temperature remains fairly constant. A well-ventilated cellar is an excellent place, but most commercial hatcherymen in the Salt River Valley prefer to use an incubator house built above ground level. The walls of the houses are often made of adobe bricks from 12 to 18 inches thick, thus insuring a rather even temperature inside the building.

TYPES OF INCUBATORS

The kind of fuel used in heating the incubator should depend largely upon its availability and price. Natural and artificial gas, coal, oil, or electricity may be used as the source of heat. Electric energy is commonly used when it is dependable and cheap, largely because of its cleanliness, safety from fire, and ease of regulation.

Where the relative humidity is rather low at all times and there is a considerable difference in the relative humidity at different times of the day, the supplying of proper moisture during the incubation period is a difficult problem. The moisture problem under such conditions has been solved to some extent, at least, through the use of the forced-draft type of incubator in which moisture is supplied automatically.

The recommendation of the manufacturer should be followed closely in operating an incubator, as incubators of different makes may vary in such details as the operating temperature.

BEST HATCHING PERIOD

If the pullets are to lay when egg prices are highest, they must be hatched during certain definite seasons of the year. Generally speaking, the smaller breeds, such as Leghorns, should begin producing eggs when they are about 6 months old, and the general-purpose breeds, about 1 month later.

Chickens mature more slowly in regions where summer temperatures are high than in those where the climate is mild. This difference in rate of maturity is probably due to the fact that feed consumption, necessary for growth, decreases as the air temperature rises; at least that is true within reasonable limits. Thus, the poultryman in a region of high summer temperature must consider its effect on the growth of his chickens in deciding when to hatch or buy baby chicks.

When chicks are hatched just prior to, or during, the high-temperature period, they are likely to develop too slowly to make profitable laying stock and will probably be undersized when they mature. When chicks are hatched too early in the year, they may mature at a normal rate, lay for a month or two, and then molt with an accompanying loss of several weeks of egg production. Under subtropical, semiarid climatic conditions, from the first of February to the first of April seems to be the most favorable time to hatch the general-purpose breeds, when they are to be raised for egg production. The best time to hatch the lightweight breeds, such as Leghorns, is during March. The information available indicates that fall-hatched chicks are not desirable in subtropical, semiarid climates when the pullets are to be saved for egg production.

Assuming that one-half of the chicks will be cockerels, that 15 percent will die during the brooding and rearing periods, and that an additional 15 percent of the pullets should not be kept as layers, about 280 chicks are needed for each 100 pullets kept for egg production.

BROODING

The canopy-type brooder, consisting principally of a circular hover and some source of heat, is most commonly used. According to availability and price, the source of heat may be natural or artificial gas, coal, oil, or electricity.

Electric brooders are popular in the subtropical areas of the Southwest when electricity is dependable and cheap. Oil-heated brooders are probably next in popularity. Coal-burning brooders are not used much because of the rather high price of coal and the difficulty in regulating the fire to take care of the difference between day and night temperatures. The recommendations of the manufacturer should be followed in operating the brooder.

For best results only about 300 chicks should be brooded in one group and there should be approximately 7 square inches of hover space per chick. A circular hover 52 inches in diameter will provide the 2,100 square inches of hover space needed for 300 chicks.

BROODER HOUSE

One square foot of floor space in the brooder house or tent should be allowed for each two chicks. Thus, approximately 150 square feet of floor space is needed for 300 chicks.

A brooder house suitable for use in mild climates is shown in figure 1. The brooder house should be placed on runners so that it may be moved easily to a different location. The wooden shutters which form part of the sides and rear of the house are closed on cold nights

and days. A canvas curtain on a roller, or canvas-covered frames which fit in the opening, may be used to cover the front opening when it is necessary. At other times the covering is removed from the front opening and the wooden shutters are opened.

TENTS FOR BROODING CHICKS

Brooding chicks in tents is a practice that can be followed when climatic conditions are similar to those in the Salt River Valley. Pos-

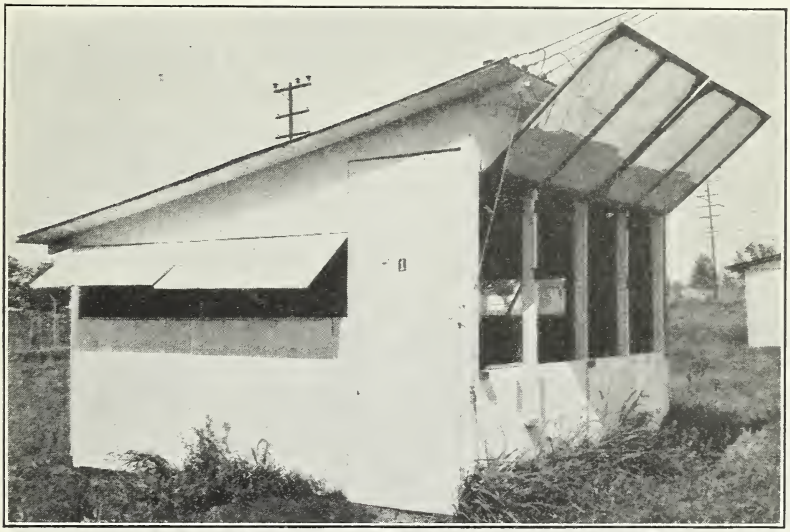

FIGURE 1.—Type of house suitable for brooding and rearing chicks, and for laying stock, in mild climates.

sibly the method may be used successfully elsewhere in Southern States during periods when the rainfall is slight and wind velocity is not great.

The chief advantage in using a tent is its relative cheapness. The difference in the cost of a tent and a brooder house is not, of course, so great everywhere as in the Salt River Valley where experiments with brooding chicks in tents were conducted. There a new tent costs from one-fifth to one-fourth as much as a wooden brooder house with similar floor space.

Five tests were made at Glendale, Ariz., in which a total of approximately 1,200 chicks were brooded in tents and the same number in brooder houses. The tests were during different seasons of the year, the range in temperature for all the tests being from a low of 25° F. to a high of 108° F. The total mortality during all tests was practically the same in the tent and house groups. The tent was warmer on most days, but cooler at night, than the house. Electric brooders were used, and probably because the tent warmed up sooner in the daytime than the house, the brooder in the tent consumed less electricity. In regions where there is abundant sunshine during the brooding season, the possible lower cost of operating an electric brooder in a tent would be an advantage.

On cold nights, during the early part of the brooding period, a circle of roofing paper was placed about 4 feet from the outer edge of the brooder in both the tent and house. The use of a similar circle is recommended whenever an electric brooder is used during cool weather without supplementary heat, as it apparently helps to conserve the heat underneath the hover. Of course, the circle must be placed far enough from the outer edge of the hover so that the chicks can move away from the heat if they get too hot. When the temperature inside the tent gets rather high, it is necessary to roll up the sides for additional ventilation.

The tent used in experimental brooding had a wood floor, with boards 1 inch thick and 12 inches wide nailed on edge on top of the floor around its perimeter. The bottoms of the tent walls were

FIGURE 2.—Brooding chicks in tents. Note the method of anchoring the tents.

fastened to the top of the boards. That arrangement aided in preventing floor drafts, and made it unnecessary to risk the rotting of the bottom of the tent through fastening it to the ground with pegs.

A tent may be supported to prevent its blowing down during windstorms by stretching it over a skeleton framework of lumber built on the same outline as the tent. The tent may also be anchored by setting in the ground small posts on each side that will extend at least 3 feet above ground level. The posts should be set 3 or 4 feet out from the corners and sides of the tent and sloping slightly away from the tent. A 2-by-4 12 feet long may then be nailed to the posts and the tent ropes fastened to it. The upright tent poles may be fastened with ropes to posts set in the ground several feet away from the front and rear of the tent. The tents shown in figure 2 are supported in this manner.

The openings near the tops of the two rear tents shown in figure 2 provide the ventilation necessary when the front flaps are closed. These openings are about 10 inches square and covered with open-mesh cloth.

If tents are used where rats may menace the chicks, additional protection may be obtained by boarding up the sides of the tent to a distance of 2 feet or more from its floor.

When the brooder used in a tent is heated by means other than electricity, it is necessary to take precautions against setting the tent on fire. Asbestos should be placed around the tent opening through which the stovepipe passes. A spark arrester placed in the stovepipe will lessen the fire hazard.

RANGE FOR YOUNG CHICKS

It is advisable to allot certain areas of the ranch for use in brooding and rearing chicks, and this should be fenced to keep out older poultry and livestock. In mild weather chicks may be let out of the brooder structure after they are a day or two old. It may be necessary to watch the chicks at first, and drive them back to the brooder if they get chilly. After they have learned to seek the brooder when they get cold, they will do it without assistance.

A 2-year rotation system of the range used for chicks and growing stock will aid in combating diseases and parasites. That is, use field no. 1 for range the first year and move the house or tent to field no. 2, planting the first field to a growing crop the second year. The rotation is then repeated by moving the house or tent back to field no. 1 the third year and to field no. 2 the following year.

FEEDING CHICKS

Chicks should be fed as soon as they are placed in the brooder house, for there is no advantage in withholding feed until they are 48 to 60 hours old. They may be fed mash four times daily for the first 2 or 3 weeks, and three times daily thereafter, keeping a little of the dry mash always before the chicks. For the first 2 or 3 weeks, it is desirable not to force the growth too rapidly. Chicks are usually started on all-mash feed until they are 3 or 4 weeks old, when fine scratch grain is added to the ration, feeding about 1 part scratch grain to 9 parts mash. The proportion of scratch grain is gradually increased until the chickens eat about equal parts mash and scratch feed at 10 to 12 weeks of age.

In the subtropical, semiarid areas of the United States, some of the sorghum grains are raised, but yellow corn is not grown successfully. In such places good starting rations for chicks may consist of the following:

STARTING MASH

Ingredient	*Parts by weight*
Ground milo or hegari	35
Ground wheat	20
Rolled oats	10
Meat scrap	13
Dried buttermilk	10
Alfalfa leaf meal	7
Bonemeal	1
Ground limestone or oystershell	3
Salt	1
Total	100

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Locally grown grains may be used also in preparing the scratch mixture. Equal parts of milo or hegari and wheat may be mixed and fed to the growing chickens.

Chicks should be allowed access to the direct rays of the sun, or 1 percent of cod-liver oil, rich in vitamin D, may be added to the mash, to insure good bone growth. Green feed should be freely fed. It may be necessary to cut the green feed into small pieces for young chicks.

Some poultrymen prefer to feed the same mash during the brooding and rearing periods, not changing until the pullets commence laying. Under such a system, growth is regulated as far as possible through the amount of scratch grain fed. For those who prefer to use a growing mash with lower protein content after the first 7 or 8 weeks, the following should prove satisfactory:

GROWING MASH

Ingredient	*Parts by weight*
Ground milo or hegari	48
Ground wheat	10
Wheat bran	10
Ground barley	5
Meat scrap	10
Dried buttermilk	5
Alfalfa leaf meal	7
Bonemeal	1
Ground limestone or oystershell	3
Salt	1
Total	100

REARING THE YOUNG FLOCK

The length of the brooding season will depend upon the weather, but it is not unusual to discontinue heat in less than 6 weeks after starting the brooder during the spring months in subtropical climates. The chicks should be taught to roost before the brooder heat is entirely discontinued.

Chicks of different ages should not be brooded nor reared together. When space is available, it is a good plan to separate the pullets from the cockerels as soon as sex can be determined. The separation of the sexes in the lighter breeds should be made not later than when they are 8 weeks old. With the heavier breeds, the separation of sexes can be delayed for 2 or 3 weeks longer.

SUMMER SHELTERS FOR GROWING STOCK

The brooder house or tent may be used as a shelter after the brooder heat is discontinued, but a tent may be found unsatisfactory for a shelter during the summer months. When a tent has been used instead of a brooder house, it may be preferable after the brooding period to use a simple structure commonly called a "range shelter." The range shelters most commonly used are somewhat similar to, but smaller than, the laying houses shown in figures 3 and 4.

HOUSELESS SYSTEM FOR GROWING STOCK

Where rainfall is slight and temperatures are high, it is often a good plan to make the growing stock roost outside of any shelter, after the brooding period. In fact, that system, called the houseless

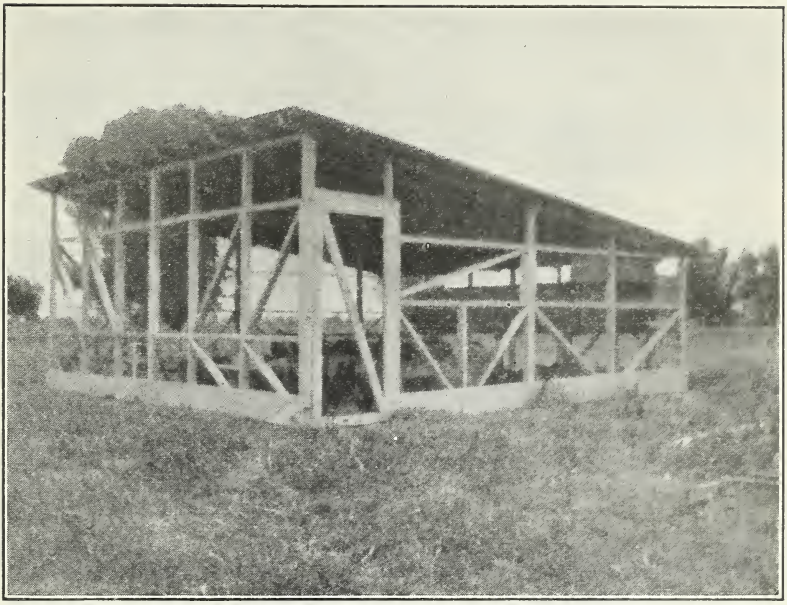

FIGURE 3.—Shed-roof house adapted for mild climates.

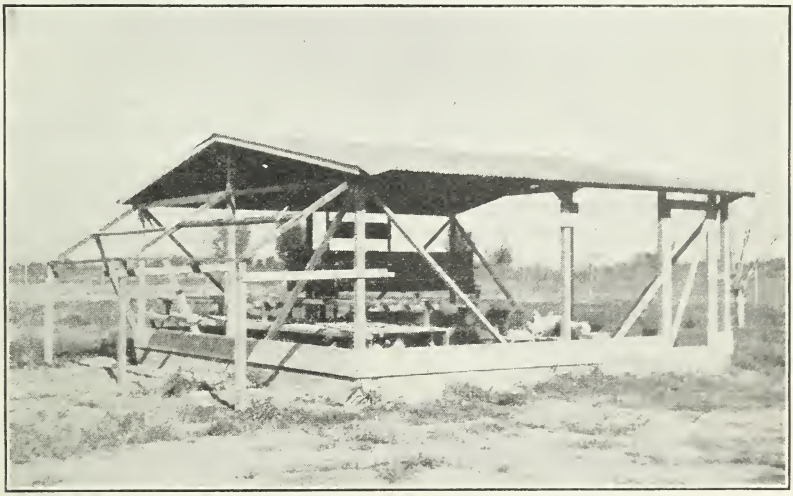

FIGURE 4.—A good gable-roof house for laying stock in mild climates. The house is 20 feet square at the base, 8 feet high in the front and rear, and 10 feet high at the center.

system, should be used for chickens after the brooding period when it is to be used for them as mature birds. The houseless system consists simply in placing the equipment other than roosts under ample natural or artificial shade, and placing the roosts on platforms in the open. The roosts should be high enough to prevent predatory animals such as coyotes from reaching the roosting chickens. In sparsely settled areas it is sometimes necessary to place poultry netting around and above the roosts as a protection against owls.

HOUSES FOR MATURE STOCK

Since the principal function of a poultry house is to provide comfort, the type of house to use will depend largely upon climatic conditions. The house should have a concrete or wooden floor. When mature stock may range outside of a house during the entire year, 2 square feet of floor space per bird in the house is enough.

CONFINEMENT SYSTEM FOR LAYERS

Because there is apparently a greater mortality than when they are allowed to range, it is not advisable to confine the layers to a house during the hot summer months in the Salt River Valley. That condition may not be true in other areas with high summer temperatures, but the poultryman should obtain information about it before he uses the confinement system for all his laying stock.

HOUSES SUITABLE FOR MILD CLIMATES

A laying house similar to that shown in figure 1 is suitable for use in regions with mild climates. The front is kept open at all times, while the wooden shutters which are part of the sides and rear of the house are closed during cold weather. This type of house may be used also in regions where summer temperatures are high but winter temperatures rather low, if suitable covering is provided for the front opening.

Laying houses similar to those shown in figures 3 and 4 are satisfactory during all seasons in the Salt River Valley and should be equally as satisfactory in other regions with mild climates. Some poultrymen cover three sides of such a house with canvas or burlap during the colder winter months, while others leave the sides entirely open as shown in the illustrations. Palm leaves are placed on the framework to the left of the house shown in figure 4 to shade the floor on hot summer afternoons.

USE OF CORRUGATED IRON FOR ROOFS

It is possible to use a corrugated-iron roof and still keep the poultry house as cool in the summer as if it had a shingle or roofing-paper roof, even in the regions of hot summers. However, the space between the roof and the floor of the house must be well ventilated, as it is in the houses shown in figures 3 and 4.

Corrugated-iron roofs that are not laid on tight sheathing, have one peculiarity that may make them unsuitable for use in colder climates than in the Salt River Valley where data were obtained on

their use. Moisture collected on the bottom side of the iron when there was a frost, and dropped onto the litter on the floors. This is not a serious fault where there are relatively few frosts, and where the morning sun shines into the houses practically every day in the winter and dries out the litter.

When shingles are costly and roofing paper must be replaced often, corrugated iron may be used advantageously to roof poultry houses or to provide artificial shade. Painting the corrugated iron with aluminum or white paint will reduce heat absorption.

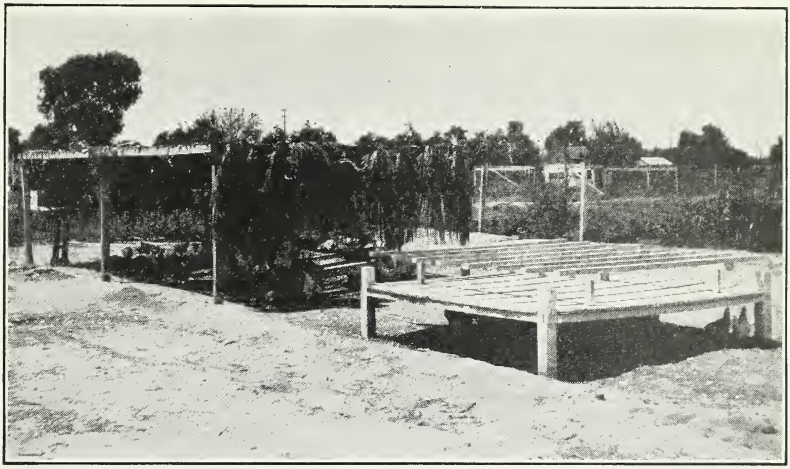

FIGURE 5.—Houseless system with equipment, other than roosts, protected by palm leaves.

HOUSELESS SYSTEM FOR LAYERS

The houseless system is used for laying stock throughout the entire year in the Salt River Valley. Otherwise the method is similar to the houseless system previously described for use with growing stock. All equipment other than roosts and dropping boards is placed under natural or artificial shade; the roosts are placed above dropping boards located nearby in the yard but without shelter. The laying flock should have the same protection against predatory animals as that recommended for growing stock.

One type of protection for equipment other than roosts is shown in figure 5. Another type, with corrugated iron furnishing the protection, is shown in figure 6.

Growing stock should roost in the open after the brooding stage if they are to roost in the open after they mature. If chickens which have been roosting in a house are forced to roost outside during rainy or otherwise unfavorable weather, it is quite possible that colds, roup, or other sickness will result.

ADVANTAGES

The chief advantage of the houseless system is its cheapness. It allows one to start in the poultry business without the initial expense of providing houses for the layers and breeders. One may also retire

from the business without the loss of money usually invested in such buildings. The roosting platforms used may be moved more easily than houses, thus simplifying the system of land rotation. In regions where fowl ticks, commonly known as "blue bugs", are prevalent, the simplicity of the system is a distinct advantage in their control or eradication.

DISADVANTAGES

Results of the experiments conducted for several years in the Salt River Valley show that the principal disadvantage in using the system is the increased number of dirty eggs during rainy weather and

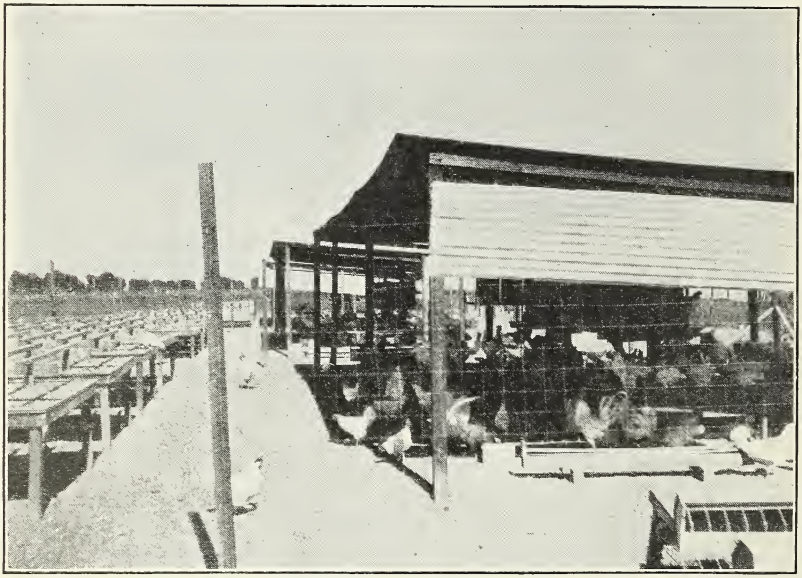

FIGURE 6.—Houseless system with equipment other than roosts protected by corrugated iron.

when the range is being irrigated. This unfavorable condition could be remedied by providing a concrete or wooden floor underneath the artificial shade and confining the fowls to it when necessary.

LIMITATIONS IN ADAPTABILITY

The use of the houseless system for mature stock is probably limited to regions where very cold weather and heavy rainfall are uncommon or unknown. In some places it is necessary to use windbreaks for protection. The windbreaks may consist of a row of trees, such as tamarack, planted close together, or a solid board fence.

EQUIPMENT

Cool, well-ventilated nests are especially important for the flock of layers during hot summer weather. The bottoms of nests are usually made of wood, but hardware cloth nailed onto a suitable frame will permit a better movement of air through the nests. Hard-

ware cloth may be used also as partitions to separate the individual nests in a battery. If wood partitions are used, three or four large auger holes may be bored through each partition to permit a circulation of air. The tops and backs of the nests should be made of 1- or 2-inch mesh wire.

FEEDING FOR EGG PRODUCTION

The laying flock should have access at all times to mash, grit, oystershell or limestone with a high calcium-carbonate content, and water.

MASH

Dry mash is usually kept in hoppers before the layers all the time. The mash may be moistened to a crumbly consistence with milk or water and fed to the birds once daily in order to stimulate mash consumption, and thus increase egg production. The quantity of wet mash fed should be limited to as much as will be consumed in 15 or 20 minutes, and it should not be fed during the hot summer months. Following is a good mash mixture:

LAYING MASH

Ingredient	*Parts by weight*
Ground maize or hegari	33
Ground barley	10
Ground wheat	10
Wheat bran	10
Meat scrap	20
Dried buttermilk	5
Alfalfa leaf meal	7
Bonemeal	2
Ground oystershell or limestone	2
Salt	1
Total	100

No source of vitamin D is necessary in the mash when the fowls receive plenty of direct sunshine. When they do not, a fish-liver oil rich in vitamin D may be added to the mash mixture at the rate of from 1 pint to 1 quart for each 100 pounds of mash.

SCRATCH FEED

It is good management to feed layers scratch grain but once daily, preferably all they will consume just before they go to roost at night. The quantity of grain to feed will vary according to rate of egg production, air temperature, and activity of the fowls, but it is not hard to gage after a little practice. As a rule, as much or more mash than scratch grain should be fed during the year.

Although it may be advisable to feed the scratch grain in the floor litter to induce exercise during cold weather, it is more sanitary to place it in hoppers. During hot weather the exercise induced by feeding scratch grain in the litter may be harmful instead of beneficial.

A good scratch feed may consist of equal parts of milo or hegari and wheat.

Of course, an all-mash ration, which excludes the feeding of scratch feed, may be used in place of the mash-scratch ration. There

are many other home-mixed and commercial laying mashes and scratch feeds which will give good results.

GREEN FEEDS

Fresh green feeds add succulence to the ration and often stimulate the consumption of other feeds. Green feeds are also rich in some of the necessary vitamins. When fresh green feeds are not available, alfalfa leaf meal may be used in the mash mixture as indicated in the laying-mash formula, or other succulent feeds such as cabbage or yellow carrots may be used. When vitamin A is not supplied by fresh or dried greens, biologically tested cod-liver oil may be mixed with the mash at the rate of from 1 pint to 1 quart for each 100 pounds of mash. Leafy alfalfa hay may be fed also from hoppers, or from buckets in which the hay is placed and partly covered with water.

WATER

It is very important that laying hens have plenty of water for drinking. Fresh water should be kept before the hens at all times because it is most essential both for the production of eggs and for the preservation of life. A laying hen may live several days without feed, but on a hot day she may not live many hours if she cannot get water to drink. Allowing layers to go without water part of the time during hot weather is certain to stop egg production even if the hens do not die. Plenty of fresh, clean water must be provided, and many poultrymen find that the use of an automatic watering system is a great help in maintaining egg production and is a labor saver as well. During hot weather, water should be placed in a shady spot where the chickens congregate during the day, as they may not drink enough water for their needs if they have to cross a hot, sunny space to get their drinking water.

CARE OF MARKET EGGS

Washing dirty eggs is not only a laborious task, but the practice is not advisable for market eggs, as washing removes the protective "bloom" from the shells. Keeping the nesting material and floor litter clean and dry are essential in the production of clean eggs. Gathering eggs frequently when open nests are used will aid in preventing eggs from being broken in the nests and lowering the quality of other eggs laid in the same nest. The number of cracked eggs will be decreased by keeping plenty of nesting material in the nests. Direct sunshine, or some source of vitamin D, is necessary for the production of strong shells that will not crack readily. Of course, some good source of calcium carbonate such as oystershell or limestone must be fed.

Eggs spoil more quickly when kept at high temperatures than when kept cool. Eggs should be collected several times daily, especially during the hot summer months, and kept in a cool, humid place before they are packed in egg cases. The egg cases should also be kept cool and humid both before and after the eggs are placed in them. A cool, well-ventilated cellar with a high humidity is probably the best place for most poultrymen to store eggs during short periods.

Since fertile eggs spoil more quickly than infertile eggs, all male birds should be kept out of the laying flock except during the breeding season. Blood rings develop in fertile eggs kept at high temperatures and make such eggs of little market value. Even if kept in a cool cellar, fertile eggs will not keep so well as infertile eggs.

IMPORTANCE OF MARKETING EGGS FREQUENTLY

Eggs should be marketed frequently, especially during the hot summer months. The members of one cooperative poultry association in a region where summer temperatures are high find it pays to bring their eggs to the receiving plant every day during hot weather. These members live close enough to the receiving plant and have a large enough volume of production to make hauling costs per dozen eggs rather small.

THE "DESERT" COOLER

Many poultrymen in the Southwest hold their market eggs in a home-made cooler that utilizes the principle of evaporation for reducing the temperature of the air (fig. 7). This cooler is known by a number of names, among which are the "desert" cooler and the "Arizona" cooler. It consists mainly of framework with burlap tacked to its sides. Tubing, or pipe, with small holes on the under side is fastened to the framework around the top, and that tubing is connected by a small pipe or rubber hose to a water container placed on top of the framework. The water container may be connected to a water faucet with a rubber hose to simplify filling, or it may be filled by carrying water to it in a bucket. Water runs from the container to the tubing around the top of the framework, and then out the small holes and down the burlap. Evaporation of water from the burlap lowers the temperature inside the cooler 20° or more on a hot day.

DISEASE PREVENTION

There is little doubt that the mortality problem is the chief one that confronts the poultryman, regardless of his location, and there are probably more failures in the poultry business because of high mortality in the flocks than for any other reason. Although some of the deaths in any flock may be due to other causes, the principal ones are generally diseases and parasites.

Prevention is the only practical method of controlling poultry diseases. For example, pullorum disease, formerly known as bacillary white diarrhea, is one of the most common and fatal diseases of young chicks. There is no cure for this infection, yet it may be prevented in young chicks by blood testing the breeding stock and eliminating those fowls which have the disease.

Eggs from infected hens should never be placed in the same incubator with eggs from healthy hens as the practice may spread the disease from infected to noninfected chicks as they hatch in the incubator. It is also a good plan to disinfect the incubator between hatches.

Chicken pox may be taken as an example of a disease for which there is no practical treatment but which can be controlled by vaccina-

tion. Although chicken pox is so mild in some flocks in the subtropical, semiarid regions of the United States that vaccination as a control measure is not necessary, in other flocks it causes severe economic losses because of mortality and decrease in egg production. On poultry ranches where chicken pox is likely to appear every year with severe consequences, chickens should be vaccinated when they are from 3 to 5 months old.

Strict sanitation is also necessary for the prevention and control of poultry diseases. Poultry houses and equipment should be cleaned

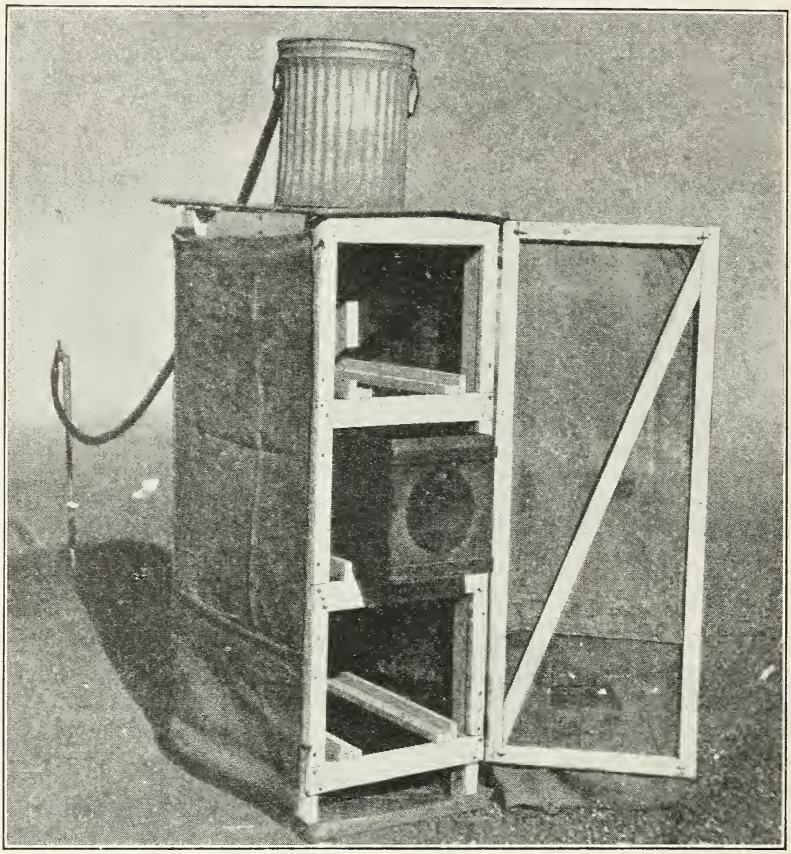

FIGURE 7.—The "desert" egg cooler.

and sprayed frequently. Dropping boards should be cleaned every day when possible, and wire netting placed between the roosts and the dropping boards to prevent the chickens from coming in contact with the droppings. Guards should be placed around the water vessels to prevent the chickens from contaminating the drinking water with droppings and other filth.

When the houseless system is used the roosting platforms should be moved at least once a month. The space underneath the roosts and feed shelters should be raked and the litter removed.

Some poultrymen who live where growing crops are irrigated allow their chickens to drink the irrigation water. The practice is not advisable as irrigation water may carry disease germs from ranch to ranch.

PARASITES COMMON IN THE SOUTHWEST

A system of land rotation is of special value in the control of roundworms and also helps to control diseases. A 2-year, or perhaps 3-year, system of land rotation similar to that recommended for growing chicks should be followed for mature stock.

Among other parasites common in the subtropical, semiarid regions of the Southwest are the fowl tick, commonly called the "blue bug", and the sticktight flea. When premises have previously been free from those parasites, it is frequently found that they were introduced by the purchase of chickens which were infested.

FOWL TICKS

The first stage of the fowl tick's development is passed on the body of the fowl. After that stage they leave the bird, and, like the much smaller red mite, live in cracks and crevices during the day and feed at night. Since they are blood suckers, they are often fatal to young chicks.

If a chicken house is badly infested with ticks and is of little value, it should be destroyed by burning. If the house is too valuable to burn, it should be sprayed with the wood preservative, anthracene oil, or with crude petroleum, care being taken that the material is sprayed into the cracks and crevices where the ticks hide. Loose boards and boxes that may provide hiding places for the ticks should be removed from the house before it is sprayed. After the general spraying, anthracene oil should be applied to roosts, roost supports, and nests several times at intervals of 3 or 4 weeks. There is no known good method for killing the seed tick on the body of the fowl, or for killing ticks when they hide under the bark of trees.

Control of the fowl tick and red mite is facilitated by constructing roosts and nests so that they may be easily examined and treated.

STICKTIGHT FLEAS

Sticktight fleas are usually found on poultry in clusters on the comb, wattles, and around the eyes. Dogs, cats, and rats should be kept away from chickens, because the former may be infested with sticktight fleas and infest the latter. As sticktight fleas breed in dust, the chicken yard and other dusty places to which the chickens have access should be sprayed with creosote oil. Carbolated petrolatum or sulphur ointment may be applied to the combs and wattles of the infested fowls. Care should be taken not to get any of the ointment in the chickens' eyes, as it may cause blindness.

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